A Study of

The MODEL RAILWAY

by

H. Rankine Gray.

Facts and Features of OO Model Railway Construction

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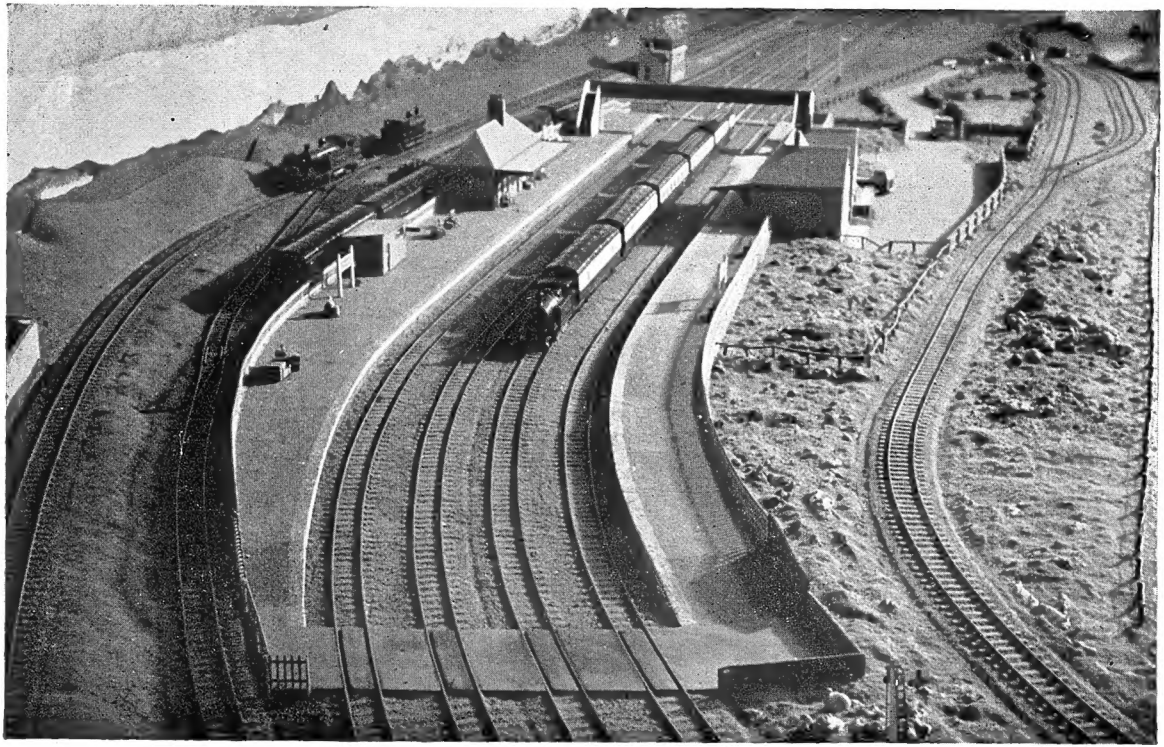

INTRODUCTION

by

The Rt. Hon. the Lord Brabazon of Tara

NO book like this one to which I have the honour to write an introduction has ever been written before. There have been books on model railways, agreed, but this one is an account of the building of a railway by two professionals. Mark the word, professionals. The difference between the amateur and the professional may appear little to the amateur, but let him try to make a living at the job and he will come up against his inadequacy very quickly. Rankine Gray has already created a very successful business in the model railway world, and now in conjunction with Hunter Wild has done an almost unprecedented thing, in showing that what he sells actually works. Frankly I always thought OO gauge was a very pleasant gauge, but that it had limitations. I no longer think that, for I have seen this remarkable railway, and even seen a long goods train backed over a diamond crossover without a derailment ! ! To those with experience, this is a high water mark in operation in this gauge.

Everyone interested in model railways dreams of his eventual layout, how it will work, the tricks he will put into it, and how it will operate at his direction. In most cases they are dreams, and very pleasant ones, but they never come true.

Read therefore an account of this marvel and, even better, go and see it. It is par excellence, unique in this country. Not only is it so up to date in latest technique as to leave you gasping, but it can be left without human operation, quietly proceeding hour after hour by itself.

I think it is a remarkable and generous action on the part of Rankine Gray, that having built this masterpiece, he writes this book to give away all his trade secrets . . . and there are many.

There may of course be philistines who will not find this book interesting because they do not love model railways and are not interested in them. I am sorry for these folk, we can forgive and forget them, realising only what they miss, but there will be countless other normal people who rejoice in the mere talk and planning of a model railway, who will find this book almost a fairy tale of accomplishment and endeavour and who will refuse to be parted from it at any time, day or night, till they have digested every word.

I am one of these lucky ones. Tonight it will be under my pillow.

To all lovers of Model Railways I commend this book, for in its field it is a classic.

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CHAPTER I

PRELIMINARY SURVEY

Any attempt to produce a survey and textbook covering fully and in detail the entire field of OO railway modelling would be a herculean task resulting in a volume too large for the average man to lift and apart from the tremendous variety of subjects involved, thousands of major and minor points would each have to be dealt with in a score of different ways. In some cases a considerable number of people may each provide a different answer to a single question, yet each can be right, as matters involving only individual taste and preference do not permit a clearcut solution ; in other cases only one correct reply may be possible and in yet others there may be either varying answers according to a host of accompanying circumstances or such delicately balanced conditions that unanimous decision is impossible even after the most detailed and protracted discussion.

It has therefore been the practice as a rule to deal in one textbook with only one or very few aspects of the subject, thus enabling the modeller to obtain a handy volume on the particular matter in which his immediate interest lies ; in some instances the efforts are spoiled by failure to appreciate the points put forward in the previous paragraph, with consequent over-insistence on this or that as the one and only course where in fact several may apply correctly to different circumstances and tastes, but the policy of specialising on a limited range of subjects in any one book is of course the wisest and most practicable general rule. On the other hand, it would seem that a single book making a wider survey of the field as a whole, and containing a certain amount of practical guidance as well as much generalisation, might serve a useful purpose for the beginner and an interesting study for the established modeller, particularly if energies are directed at times to discussion of some of those fundamental and indefinite matters which tend to receive too little attention and yet are responsible for a great proportion of the problems and disappointments of many enthusiasts.

In view of what has been mentioned of the advisability of adhering to a limited range of aspects in any one book, is it possible to skim over a very wide portion of the field quickly and yet retain any real value or interest ? Apart from the submission to the public of this book itself, no attempt will be made to answer that question dogmatically and it will be left to the reader to arrive at his own decision, but at least it can be said that under normal conditions the experiment would be left to others, should they fancy tackling it ; there is however one factor which encourages a task of this general nature to be undertaken, as the writer and his partner in the venture, H. Hunter Wild, have constructed a rather ambitious public exhibition layout which, although in constant operation hour after hour and day after day since the beginning of June 1949, has proved so efficient and trouble-free that unanimous praise has come from all sections of a modelling and non-modelling public already growing

tired of the derailments, breakdowns and constant need for manhandling which have so frequently been offered in the past under the description "exhibition model railway".

In short, efficiency and reliability can be achieved in OO railway modelling under appallingly arduous conditions and it is hoped in these pages to convey to the public a variety of basic hints which will enable these desirable features to be achieved by every enthusiast ; as has been indicated already, the operational failures which detract all too frequently from the pleasure of the average modeller arise from simple fundamentals or the neglect of them and special attention will be given to these aspects. In addition, some modellers feel that while their scenic effects are good, they lack some touch of realism which would lead to greater satisfaction ; brief descriptions of the methods used in the case of the scenic side of The Model Railway may provide handy hints and ideas and will therefore be included in this book, together with general notes and statistics relating to the layout and references to whatever other points appear likely to offer either helpful guidance or popular interest.

It is then The Model Railway, Boscombe, which provides that encouragement to tackle sketchily, yet perhaps usefully, a subject wide enough to be too frightening unless some sort of limit were set ; by confining much of the discussion to what was done, what was learned and what was chosen in connection with this particular layout, fairly definite boundaries are provided, as it can be made clear that the hints, ideas and methods put forward are certainly not claimed en masse as necessarily the ultimate best, but rather as thoroughly satisfactory, economical and reliable and the best known at the time for the circumstances and conditions concerned. From this it will be appreciated that as the slogan of The Model Railway, "It's Britain's Best", is very widely recognised as fully justified, the methods adopted in the construction of everything from baseboards to the final item of scenery can quite reasonably be advanced as worthy of attention ; many modellers will prefer to use their own alternatives or to develop variations of the ideas given here, but each of these ideas does at least provide a basis which has been proved to give excellent results.

It must also be pointed out that a public exhibition layout of considerable size is designed and constructed to give an entertaining and realistic spectacle and, as applies also to the great majority of private layouts, it is not intended that it should be inspected minutely with a magnifying glass ; on the contrary, a model meant for such inspection at extremely close range is seldom as effective for general examination as one designed for the latter purpose. Even so, the workmanship in one case must be as painstaking as in the other and as a rule the same basic principles of method and construction apply, the real difference being in matters of detail and emphasis ; there is in fact a considerable art in determining the relationship between the modelling required to give a desired effect and the viewing distance from which it will normally be seen. An examination from different ranges of an oil painting will make this point clear, as very close inspection of some excellent pictures produces only a jumbled confusion of colours ; it is often failure to appreciate that to some extent this applies also to OO modelling which causes the criticisms, on occasion quite bitter, between varying schools, as the work of the superdetail enthusiast may in some instances

be as unsuitable for *general* examination as can be the reverse. Taking a rather obvious example, a model village can be considerably reduced in apparent depth if the same amount of detail (amongst other things) is applied to the farther buildings as to the nearer and this general point must be kept in mind when suggestions in these pages are adopted.

Many of the notes provided are of necessity comparatively brief, as the main object is to provide basic ideas from which the modeller can develop his own methods of procedure and although he will no doubt run up against problems of detail or process which he must solve for himself, this is unavoidable if the aim to offer the book at a popular price is to be achieved. In other instances the brevity of references is due to the fact that they concern aspects which cannot be covered sketchily with benefit either to expert or beginner and in such cases the only wise course is to study the matter in a textbook devoted wholly to the subject involved.

It might helpfully be mentioned at this point that with the exception of the relays used for the automatic operation of the layout, The Model Railway is built entirely from standard materials and equipment available to the general public and anyone contemplating entering the delightful field of OO railway modelling, with its vast variety of interests from miniature engineering to artistic expression, cannot do better than obtain The ERG Catalogue and Manual ; it includes helpful articles and full details of all leading components and equipment by reputable manufacturers, thus enabling the would-be modeller to weigh up the situation before taking those first vital steps on the correct guidance of which so much depends. The ERG Catalogue and Manual, a substantial looseleaf volume with a service of supplements by which it can be kept up-to-date, is available at 2s. 6d. from leading model shops throughout the country or can be obtained at the same price post free from ERG (Bournemouth) Limited, 529 Roumelia Lane, Boscombe, Bournemouth, if no model shop or ERG Stockist is situated within convenient reach.

CHAPTER II

BASEBOARDS

The success of any layout must obviously depend to a very considerable extent on the trackwork and the foundation on which it is laid ; these subjects therefore deserve more space than may be given to later aspects and each is entitled to its own chapter.

In many cases there is such impatience to get to the building of the railway itself that too little care is taken in construction of the baseboards, but whether a layout is to be permanent or portable, the base on which it is built is of vital importance, as any failure to provide a rigid and stable foundation must automatically involve a grave risk of distortion and damage either while the layout is being constructed or, more disastrously, at some future date, when any attempt to strengthen an underlying weakness may be well-nigh impossible without causing serious damage to track, scenic surface, buildings and other features into which there has been put painstaking work. Where a layout has varying levels and extensive sections in tunnels or below high level tracks, the need to interfere at any time with the original baseboards can become an even more gigantic and heartbreaking task.

In the case of The Model Railway it was decided that maximum use of the 32ft. x 28ft. rectangular hall could best be made by building the layout as nearly as possible round the walls and admitting the public to the central well ; other

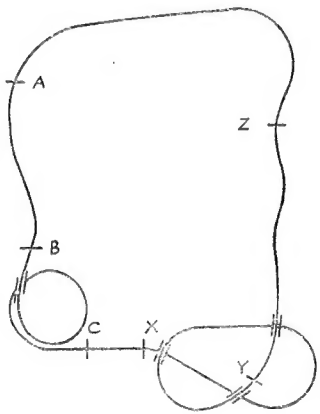


DIAGRAM 1

decisions involved a height of three feet from the floor for main baseboards and continuous circuits round the hall. Unfortunately a rather low ceiling, slightly less than eight feet above the floor, involved a drop of 18 inches from main baseboard level to a height at which reasonable headroom would remain over a special stairway which had to be provided to allow public access to the central well. As it had been agreed that 1 in 40 was to be the maximum gradient, the sixty feet of track needed for a drop of 18 inches could only be achieved by introducing a spiral gradient in one corner beside the overstair, with a second spiral in the corner beyond the stairway ; the entire spiral at each side had to be hidden in the interests of general realism and, in addition, each had to commence rather below the standard level of three feet agreed for baseboards, thus introducing the need for a steady gradient along most of each of the longer sides of the layout. This is all illustrated in Diagram 1, where a single line is used for simplicity instead of the three circuits which do actually use the spirals and pass under the special entrance stairway.

On the left of the diagram the gradient runs downwards from A to C, but only the stretch from A to B could reasonably be made visible ; similarly, of the climb from X to Z, only the length from Y to Z was considered suitable for viewing. A very considerable part of the available space would therefore have little interest for the spectator as far as these particular circuits are concerned and an upper layer was obviously desirable in each corner ; Diagram 2 illustrates the form of this, a simplified track again being shown, with broken lines to indicate baseboard area.

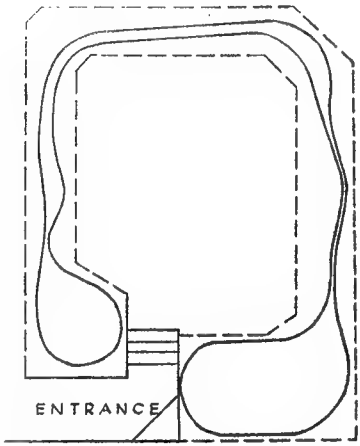


DIAGRAM 2

These diagrams are more or less symbolic, as they omit the various twists and turns of the tracks as actually laid, but it will be seen that the spirals already involve double layers of baseboards and if the track shown in Diagram 2 is super-

imposed on that shown in Diagram 1, it becomes clear that a third level is added over the spirals, each level being separated by only a few inches from the next.

Returning to the original question of a rigid and stable foundation, it is quite obvious that failure to build with adequate strength could be nothing short of disastrous if it involved the need to attempt later to alter or re-inforce such triple-layer formations where considerable portions are inaccessible as far as major work is concerned. The briefest glance at Diagram 3 will confirm this, yet it must be pointed out that this intricate pattern is only the result of super-imposing one *simplified* track plan on another *simplified* track plan !

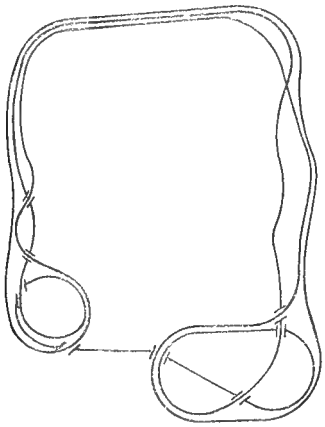


DIAGRAM 3

The object of the foregoing analysis is less to refer to the problems involved in the planning and building of The Model Railway than to stress the importance of proper attention to baseboard construction, with thought for how later work may affect access to earlier efforts and with the point borne in mind throughout that repairs and re-inforcements may be virtually impossible in some parts when the model is completed.

It will not now be difficult to appreciate that the greatest possible care was taken in planning and constructing the baseboards of The Model Railway and this part of the work carries a considerable portion of the responsibility for the eventual freedom from running troubles. Bearing in mind that careful attention had to be given at every stage to completing such trackwork and wiring as could not be dealt with when the next level had been added, modellers may find interest in a brief description of the general construction of the baseboards of this lay-out.

As it is essential to have a working surface which will hold nails and screws permanently and as seasoned timber was not available, the choice was Weyroc Building Board, which was obtained in sheets 7ft. 6in. x 3ft. 6in. x ½in. This

timber substitute, with its great strength and beautifully smooth surface, consists of small shavings and particles of wood, resin-bonded under high pressure ; without going fully into its many qualifications for such a job as this, it can be said that if seasoned timber were readily available, Weyroc would again be the choice for baseboards in view of the great satisfaction it has given in every way.

The entire structure forming the foundation of the layout was strengthened in every possible manner with two-by-two timber, angle iron, shelf brackets and, where advisable, with flat gussets of Weyroc taken from the inevitable scrap ; as each section of baseboard was completed, it was fitted to the previous section with as much thought for permanence and strength as was given to the construction of the section itself. Ultimately, with the insertion of the final section, the entire baseboard formed a great hollow rectangle of such strength and rigidity, and mounted on such an adequate number of well braced two-by-two legs, that no portion of it could distort even under conditions far worse than the most adverse which could be imagined and, in addition, no harm could arise as a result of the combined weights of the two builders of the layout, who frequently had to work on top of the baseboards.

Gradients rising above standard baseboard level were carefully built on to the main boards to permit trackwork on raised embankments, but where tracks had to drop steadily below the normal level, two methods were employed. Where appropriate, the rear portion of the surfacing was secured horizontally, while the front portion was fitted wholly on the slope as in Diagram 4.

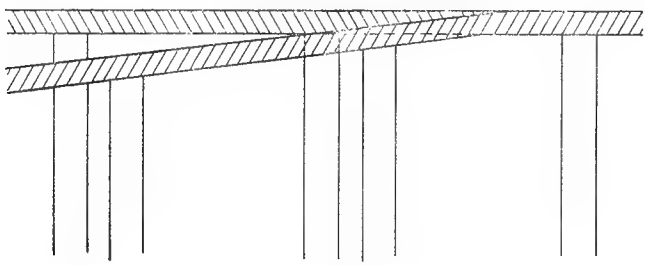


DIAGRAM 4

In other cases it was not possible to build in this fashion, as tracks heading downgrade into cuttings were required ; where such a need arose for a sloping bed in the middle of a board, the board was cut lengthwise on each side of the proposed cutting, a length of angle iron then being bolted at frequent spacings along the under side of each edge of the narrow strip forming the graded section. As is shown in Diagram 5, the strip bound with angle iron was then pulled downwards at one end after the rest of the board had been very securely anchored in its horizontal position.

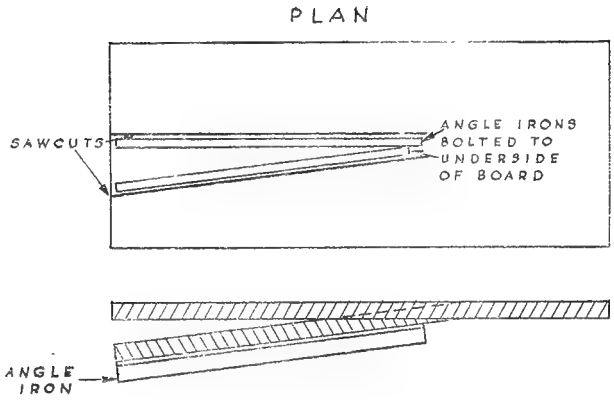


DIAGRAM 5

By such methods as these the entire foundation on which the railway and countryside were to be built became a single unit in which no section could fail either in its own strength or in its position relative to other sections ; few private layouts involve quite as many problems, but each has its own and it is hoped that the reader will now feel that it is not only well worth while, but vitally important, to ensure before commencing further tasks that the foundations on which his later work will depend are above suspicion in every way.

CHAPTER III

TRACKWORK

Many readers will consider it a foregone conclusion that the entire trackwork would of course be built from ERG Unit Construction OO Track Parts ; in some cases this choice will be considered obvious on the grounds that an E. Rankine Gray partnership would certainly use ERG productions **because** they are ERG productions, but others will know that the choice is obvious on the grounds that ERG Track is outstandingly the most suitable for the proposition concerned. This is the correct reason and very little thought indeed will establish it as a fact that in a venture such as The Model Railway, no personal prejudices or preferences could conceivably be allowed to jeopardise the success and efficiency of the layout. In dealing with various features of The Model Railway, references to products of various makers will be found and these alone should indicate that every effort is being made in this book to avoid bias, but nevertheless to give all possible praise where praise is due.

Quite apart from relying on these assurances and lines of reasoning, a survey of the requirements of The Model Railway inevitably leads to the same answer every time where trackwork is concerned and at the risk of labouring the point unduly, the conditions which had to be covered will be discussed fully, as it will instil considerable confidence in the reader if he can be shown conclusively that every choice was made with the success and efficiency of The Model Railway invariably the ruling factor. If this is conveyed convincingly, it will serve the double purpose of recommendation of sound items and, much more important, impress on the reader that in the selection of any equipment or materials for his layout, the most careful consideration of every aspect of his requirements is essential ; it is a great mistake to choose this or that item on only a limited number of the operative points needed, because in due course it may turn out that although the product selected is excellent in many ways, it fails to cope with some special condition the modeller ought to have foreseen before committing himself. Here then, as a practical example, is a detailed approach to the choice of trackwork for The Model Railway.

It appears to be a fairly widely held opinion that the construction and exhibition of a model railway layout is an assured commercial success ; on the contrary, it involves very substantial outlay, especially as man-hours must certainly be charged to cost where a commercial proposition is concerned, and every modeller is aware that a very great amount of time is needed for the construction of a good layout. On the other side of the picture is a very hazy impression of the probable returns and it is therefore most important that, subject to no sacrifice of quality, every possible economy should be made. The initial price of track parts is not a big factor in overall cost, but to the fact that ERG Track Parts are the most economical in first cost must be added the more

important facts that they can be built into finished track more quickly than any other good 2-rail track parts and that they provide a finished appearance second to none (as can be seen from photographs in this book).

Important as are these aspects, the vital clauses of specification are still to come ; these concern strength, reliability and durability. Taking them in the order written, the question of strength was of considerable importance, as it appeared that in the case of The Model Railway, means of access to some parts in emergency or for cleaning could only be allowed ideally if it were possible to walk along the tracks. The use of ERG Track covered this point and no fears are incurred when it becomes necessary to walk boldly along the rails to some otherwise inaccessible spot ; such strength may not in most cases be required for the same reason, but it cannot fail to reassure to know that it is present.

Reliability is of course a matter of the greatest moment if a layout, either public or private, is to be classed as really good ; this particular quality must cover many things, but at this stage the term is being considered with regard to those aspects associated with trackwork, where smooth running and complete freedom from derailments are the requirements. It would not be unreasonable to assume that every private modeller would accept such requirements as a prime essential, while in the case of commercial work and even more especially in the case of a layout for public exhibition, surely it can be said that unless every possible step is taken to achieve reliable running completely free from derailments (other than for such exceptional causes as arise even in full size practice), the work concerned must stand condemned. Such a view was taken throughout with regard to The Model Railway, but it is a regrettable fact that many layouts, both private and public, do little to bear out any suggestion that this outlook is universal ; in fact, the all too common acceptance of frequent derailments as natural and inevitable cannot but convey the impression that in many quarters completely reliable running is considered too much to expect in OO gauge.

Such a view is entirely wrong, although undoubtedly a mishap will crop up now and again and in this The Model Railway is no exception ; on the other hand, a mishap is in itself an exception and a very rare one too. Hour after hour and day after day, whether trains are running on regular circuits or are being manoeuvred forwards or backwards over intricate pointwork, the complete freedom from derailments and similar accidents calls forth endless comment and surprise, bearing out that people are accustomed to a far less satisfactory standard, particularly when viewing public exhibition layouts.

The standard demanded of and achieved by The Model Railway is not detailed in a boastful manner ; it is in fact so taken for granted that were it not achieved, the layout would be closed as unfit for exhibition to a paying public entitled to an honest display of high standard. Why then has so much space been devoted to emphasising the highly successful running and to comparison with widely accepted lesser ideals ? Simply to offer proven results and practical experience as sound qualifications for discussing how higher standards can be reached by the average railway modeller (and especially the newcomer to the hobby), who is too frequently induced to aspire to too low a level. Sometimes this is the result of accepting the findings of modellers whose own efforts are none too successful and who yet

detail their experiences as fine achievements, thus setting inadequate standards ; in other instances, enthusiasts are misled by armchair critics without practical experience and in yet others they are caused to overlook the simpler fundamentals as a result of too much advanced discussion of abstruse non-essentials. It is a very easy matter to be led astray by failure to appreciate that some such factor is involved and the wise modeller takes particular care to curb the tendency.

How then has such reliable running been attained in the case of The Model Railway and how can it be attained by every OO railway modeller ? The results do not spring from any exceptional skill nor are they based on any magical secret, unless the determination to incorporate painstaking care and forethought are taken by any reader as such skill and magic. The importance of baseboard construction has already been emphasised and further essentials are the adoption of the right principles, the choice of suitable components for the circumstances concerned and unrelaxing care and attention.

Very definite standards of reliability have been outlined, but although this quality depends initially on the care and attention given to the construction of the track and on selection of track or track parts suitable for the conditions, it must remain dependent next week, next month and next year, on durability ; just as it is useless to build baseboards which fail to retain their strength and stability, so it is useless to lay track which fails for any reason of quality or special conditions to maintain its accuracy. The Model Railway has been built to give day in and day out service over a period of many years and if constant adjustments and repairs were needed in the case of trackwork, the task would be formidable, while the regular recurrence of any need for adjustments would also entail regular running troubles, as it could not be hoped that inspection alone would reveal every discrepancy which arose ; in addition, it will be recalled that in each corner are three layers of track, two of which cannot be reached for accurate work nor even be examined closely, and there is the fact too that many parts of the visible trackwork, although within extended reach in emergency, are not accessible for close work owing to later addition of scenic effects.

In some quarters it may still be thought that a crazy faith was needed to arrive at a decision involving the boxing in of long lengths of track in a case where many years of trouble-free running was an essential demand, but such a view is quite wrong ; had the decision been made without full consideration of all points, it would have been the height of folly, but everything was taken into the calculations, including the effects of temperature variation, timber shrinkage, vibration, humidity changes and other less obvious factors, yet it remained clear that ERG Track Parts would fill these very rigorous requirements completely and that as long as adequate workmanship achieved initial reliability, the principles on which the track construction is based and the materials concerned would ensure permanence of this reliability.

The choice of track thus fulfilled the conditions demanded, as thorough scrutiny gave complete satisfaction regarding reasonable building time, economy, strength, realism, reliability and durability ; the minute attention given to this choice may appear unnecessarily painstaking, but consideration of the problems involved and issues at stake should remove such an impression and indicate that

every modeller would be well advised to weigh up his personal requirements just as thoroughly, making certain that his final selection of track or any other essential equipment is **right for the particular circumstances concerned.**

Considerable space has been allotted to this subject, as it perhaps fails to receive adequate attention in the majority of modelling textbooks, but less need be written about the actual laying of the trackwork of The Model Railway ; odd points which may be of value do come to mind and will be dealt with at this stage, but details of the design of the layout will come under a later heading.

Sub-bases were laid to suit the site and without slavish adherence to particular radii ; wherever possible, transitional curves were built and where this could not be applied throughout, a transitional lead-in was incorporated. Sub-bases in their usual rigid form were used in many places, but for transition or where a very gradual curve was required, the bases were saw-slotted at 20mm. or 40mm. intervals, each slot running from the inner edge of the base to within a quarter of an inch of the opposite edge ; this method, illustrated in Diagram 6, was applied either to straight or curved base timbers as required.

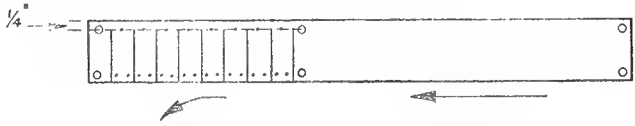


DIAGRAM 6

In some cases a base may be slotted along its whole length and in others it may be necessary to slot only part of the length, as in the diagram, where a base is shown for a straight track which is to run into a gradual curve.

As a general rule, sub-bases were screwed in position for complete security, with three ⅝in. countersunk screws per side for each 18in. base, but where advisable, extra screws were inserted ; slotted lengths were however secured by means of fine wire nails, three being used for each section (as in Diagram 6) unless any sign of unevenness indicated the need for more. It is hardly necessary to mention that great care was taken to ensure that adjoining ends of bases were at the same level.

The addition of sleepers, ballast and rails calls for little comment, as the processes are fully detailed in The ERG Catalogue and Manual, but it might be said that every foot of hidden track is fully sleepered and soldered ; any attempt to scamp work on hidden stretches is bad policy in the long run, although the omission of any feature of purely scenic value is of course natural.

Fishplates were avoided throughout and perfect electrical continuity assured by the use of a bonding wire across every rail joint, the wire being carefully soldered at each end ; it is important to note that such wires should not be taut, but looped as in Diagram 7, because although the multiple soldering of ERG

Track at every sleeper, each of which is secured by four pins, gives such strength that it prevents distortion of rails even in extremes of temperature, a taut wire may be stretched enough by contracting rails to cause a fracture, with consequent electrical failure.

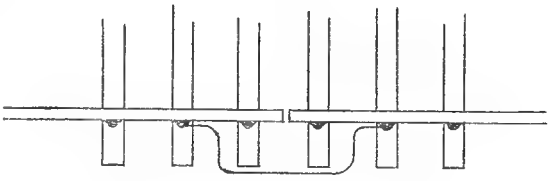


DIAGRAM 7

The diagram also illustrates the wisdom of soldering the bonding wire to pins other than those at the extreme ends of the rails, thus avoiding any disturbance of the alignment and levels of the adjoining rail ends, between which a slight gap should of course be left.

All pointwork was constructed in position from odd scraps of rail, but no wholly inaccessible point was permitted in the planning ; a carefully constructed point, with blade movement adjusted accurately to prevent undue pressure from excessive point motor throw, will give years of heavy service without attention, but allowance for the possible need of maintenance work is highly advisable. Similarly, a well made point should be as free from derailments as a length of straight track, irrespective of direction of travel and whether a train is being pulled or pushed, but there remains the possibility of careless switching of a point when a train is actually passing over it ; even with a comprehensive system of indicator lights and the foolproof automatic running of The Model Railway, the human element could introduce a tangle in an awkward spot when for any reason the control was taken over manually. It would have been an easy matter to include interlocking safety devices to cover this latter aspect, but the possibility of maintenance work being required was the deciding factor and the risk of human error is mentioned for the guidance of the private modeller who might overlook when planning his layout that a point in a particular and unseen position should be avoided unless some safety device is incorporated.

As the operation of points will be covered in a later chapter, an immediate approach can be made to the question of complete eradication of derailments and similar mishaps ; so far the emphasis has been on accuracy, care and forethought in constructing baseboards and trackwork, but when running tests are made, it is by no means certain that the entire track and all points will provide perfect results under all conditions. It may turn out that on every circuit a derailment occurs at a particular place or it may be that there is intermittent trouble at some definite spot ; thorough tests for just such difficulties must be made with every train available and under varying conditions. Fast and slow, pushing and pulling and each of these in either direction . . . all must be tested wherever

such conditions may be required in the operation of the layout and it is in fact necessary to carry out under the stiffest possible conditions every movement which may normally be required.

(As adjustments may be needed to correct any faults which are brought to light, it must be remembered that track which will become difficult of access should be tested and passed before being boxed in).

In studying such problems as appear when searching tests are made, it is advisable first to determine whether any particular difficulty is due to something other than a track fault ; possibly on excellent track there may arise some mishap as a result of buffer lock or of a faulty coupling which jams following a curve, while an inaccuracy in back-to-back spacing of the wheels on a single axle and such things as a twisted bogie frame or wagon chassis can be prolific sources of trouble. On occasion it may take considerable time to locate such a cause, especially if the fault appears only momentarily under some special set of circumstances, but discovered it must be !

Assuming now that any mishap still occurring is not due to conditions associated with the locomotives or rolling stock, attention can be turned wholly to the track. Perhaps the gauge is a fraction wide or narrow or a check rail is a trifle tight ; perhaps a badly aligned rail joint or a faultily seated point blade catches a flange and causes the wheel to ride up the rail or perhaps the throat or frog of a point fails to give free passage.

These are all quite common problems, but in view of the varying conditions which may apply to different layouts, no attempt will be made here to compile a complete list ; nor is such a list necessary, as the fundamental object of this section on reliable running is to impress with all possible emphasis that **every derailment or mishap has a cause.** If this simple fact is grasped, it depends entirely on the modeller concerned as to whether or not he has the interest and patience to find the cause and work on it until it has been remedied ; sometimes discovery and remedy are by no means easy and at other times the discovery may be simple and the remedy awkward or vice versa, but whatever the conditions, cause and remedy exist and the achievement of wholly successful running is within the reach of every OO modeller.

Before this chapter is closed, there is one small point which looks obvious, yet is frequently not seen. Having achieved completely reliable running, it is wise to accept the trackwork as in order and assuming nothing happens later to make it suspect, any trouble which occurs in the case of a new engine or train should be sought here **and not in the trackwork ;** all too frequently modellers make the mistake of adjusting good track to a new train instead of the reverse, with the disappointing result that trouble arises with the trains which have been running perfectly hitherto.

CHAPTER IV

TRACK PLAN AND GENERAL DATA

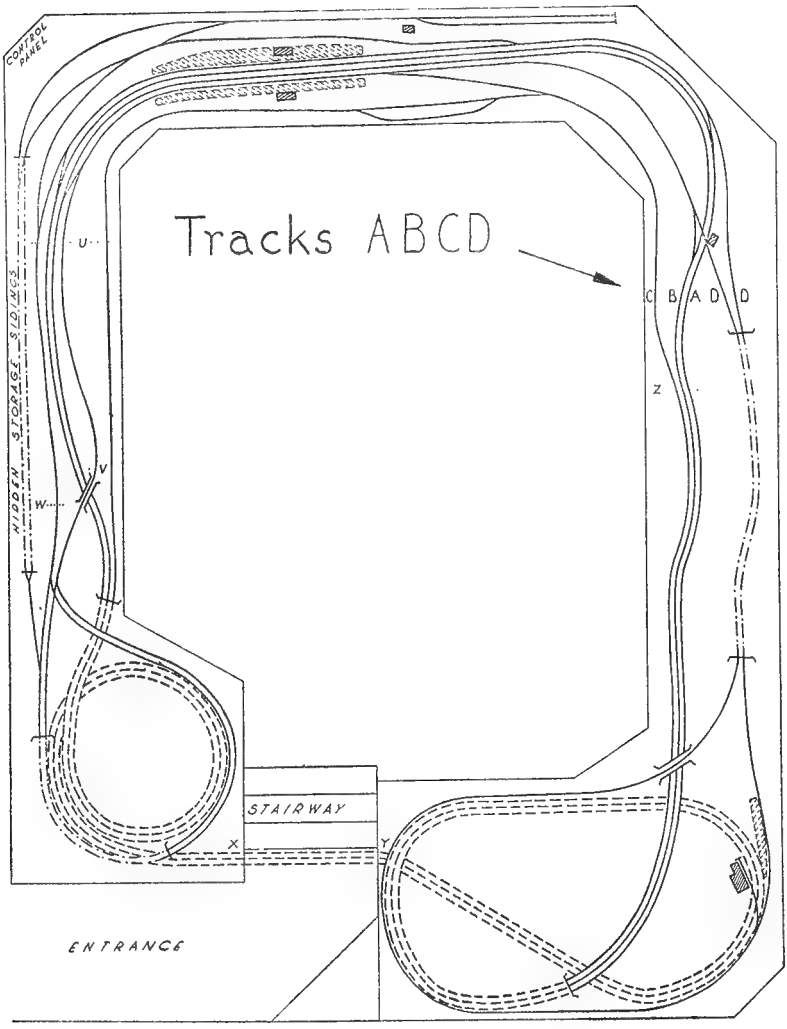
The foregoing chapters have been somewhat trying to compose, as it is far from easy to write compellingly and convincingly on general, negative or vague aspects of a subject, but it was felt that the time had come when someone must endeavour to discuss the background of mental approach without which the most careful adherence to a dozen textbooks may prove fruitless ; no doubt the reading of these same chapters has been equally trying, but if they have conveyed how vital for true satisfaction is the need of careful thought and intelligent foresight, neither the writing nor the reading has been wasted. Nevertheless, relief for writer and reader alike will be welcome and perhaps this can best be offered in the shape of factual details of The Model Railway, after which attention can be turned to general descriptions of such things as the automatic working, the electrical system, rolling stock, scenery and how various effects were created.

Probably the most suitable starting point is the track plan, which appears overleaf ; the layout illustrated was not worked out in advance, but was developed as work progressed, the main objective throughout being to provide the best possible spectacle for the public. A point borne always in mind was the necessity of eliminating all trace of sequence and clockwork monotony and the trackwork was designed to aid this aim, just as the electrical system was developed later with the same purpose under constant consideration.

Basically the layout comprises four main circuits ; three of these (Tracks A, B and C on the plan) are continuous tracks round the room, with approximately twice as much length out of sight across one end as is visible round the remaining two sides and opposite end ; the long spiral gradients already mentioned show how this deceptive result is achieved and also make possible the very misleading loss of height between tunnel mouths and the nearby overstair beneath which the trains run. It will be realised that where upper level track is drawn side by side with one or more lower levels, the tracks are in actual fact one above the other, but this cannot be shown in the plan without the production of confusing results.

The fourth circuit (Track D) also wears a certain amount of disguise, as it consists of a horseshoe with a loop at each end ; as will be seen from the track plan, the loop in the left-hand bottom corner is double and so arranged that alternate trains go round clockwise and anti-clockwise respectively.

Track D is viewed as the local line and by bringing Tracks A and B under a single track flyover, the effect in the main station is a four-track way with the slow lines along the platforms and the fast lines in the centre. Two crossovers at the left-hand end of this station and one crossover and an outside slip at the main junction near the top of the right-hand side of the layout permit complete



Gradients :

U to X	.....	1 in 40 down	U to V	.....	1 in 58 up
Y to Z	.....	1 in 40 up	W to U	.....	1 in 72 down

interchangeability in either direction of travel between the slow track and either of the fast tracks, while by running round one or other of the end loops of the local line, a change from clockwise travel on one fast track to anti-clockwise travel on the other fast track can be made.

The innermost line of the three circuits (Track C) has no elaborations other than a passing loop and a branch track giving access to Track D ; normal running on Track C is anti-clockwise and the branch therefore gives direct connection to the main station (and thence to any other track), but to return to Track C it is necessary to reverse over the branch. Track C is used for a Southern Electric unit at times and this introduces a pretty problem ! Whereas everyone is delighted with the absence of a third rail on the tracks of The Model Railway, only three in a count of more than thirty thousand have commented on the absence of a third rail for a track carrying an electric train and there is sound reason to believe that few who have made no comment have spotted the point ; it is interesting to speculate whether, from the point of view of the average spectator, the addition of a dummy third rail in the interests of accuracy would not detract more than its own value from the obvious enchantment of the two-rail effect as a whole. A dummy third rail was of course planned, but in the light of reactions so far, it has not been decided yet whether it is to be added or omitted. It is of no great moment that a few hands will be raised in horror, not only if the third rail **is** omitted, but that such a possibility could even be the subject of consideration, because within reasonable bounds it is a first duty to offer the viewing public the greatest satisfaction ; doubtless this opens a further matter for dispute in a very limited circle, as such a flagrant breach may not be accepted as "within reasonable bounds", but it can be stated very emphatically that any who feel ultimately that there is no worthy basis of argument, or that no two answers to this problem can be accepted as permissible possibilities, have closed their minds to certain aspects they prefer not to admit.

Although it is not easy to make clear in a word picture, the notes on running may have made it plain that a train can be run quite readily over the entire track-work without change of direction, if the run commences on Track C ; it is of course necessary to cover certain short sections of track twice to complete this run, which takes close on 20 minutes to make at an average speed of 35 scale miles per hour.

A number of factual details will crop up in varying chapters to follow, but it may be of interest if a summary is given here ; consideration of some of the points mentioned will perhaps convey an inkling of the vast amount of work which must be put into a project of this nature, though it is doubtful if any but a few of the most experienced modellers will be able to grasp fully the whole extent of the task.

The layout, roughly 30 feet x 25 feet along its outer edges, was built entirely by E. Rankine Gray and H. Hunter Wild in approximately 10,000 man-hours and at a cost of £4,500 (including its average complement of locomotives and rolling stock) ; there are 814 feet (roughly 11 scale miles) of ERG Track, requiring some 25,000 sleepers, 100,000 track pins and over 50,000 soldered joints. Electrification is two-rail, with fully automatic operation (which will be dealt

with in subsequent chapters) by 170 electro-magnetic relays and over 7,000 feet of wire ; the auto-control can handle a maximum of 23 trains simultaneously, but only 9 trains are run as a rule for normal exhibition purposes. Alternative manual control is by 14 rheostats and 68 switches. In each year during the hours when the exhibition is open to the public, the 9 trains in everyday use cover an aggregate of more than 9,000 **actual** miles . . . the distance from Britain to Australia ; in $2\frac{3}{4}$ years the total distance covered by these 9 little trains is roughly the circumference of the world !

CHAPTER V

OPERATIONAL EFFECTS

In the limited space available, it is out of the question to describe in detail **how** the operation of The Model Railway is achieved, but rather more can be said of the results ; this will in any case be of the greater interest to the majority of readers, so will be covered first, with less explicit notes in Chapter VI on some of the basic means by which the results are obtained.

As has been mentioned already, normal running is fully automatic and was worked out with the definite object of avoiding any regular sequence ; public reaction has proved that this aim and the somewhat mystifying results of the track design add tremendously to the enjoyment of the spectator.

The basic principle of control is the effect of each train on the one following it on the same track ; as a train enters a new section, it switches off the section it has just left and switches on the previous one.

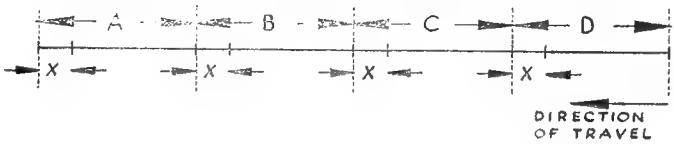


DIAGRAM 8

In the arrangement shown in Diagram 8, while a train is on Section B, Section Cx is dead, but just after the train has passed from Section B to Section A, Section Bx is switched off and Section Cx becomes energised ; a train waiting on Section Cx then moves on until it reaches Section Bx, switching off Section Cx and switching on Section Dx as it travels. Whether the train halts on or proceeds through Section Bx depends on whether the train ahead is still on Section A or has passed beyond it.

It is not difficult to see that on a continuous track this system can handle any number of trains up to one less than the number of sections ; as the four main tracks of The Model Railway have a total of 27 such sections, a total of 23 trains can be handled by the automatic control, the figures for the various tracks being as follows :

Track	*Number of sections*	*Maximum no. of trains*
A	9	8
B	10	9
C	5	4
D	3	2

According to the number of trains on a track, the frequency of automatic halts varies considerably, though variations in lengths of sections have the effect of causing fewer longer stops or more frequent shorter stops as the case may be ; it would not be easy, especially in view of additional complications which will be mentioned later in this chapter, to explain just what stops are involved with the usual complement of nine trains, but this number has been selected partly because it gives a fair chance of a straight run for a slower train, with only one stop for a faster train on the same track, unless the disparity in speeds is considerable.

The task of incorporating gradual slowing down and re-starting for all automatic sections could not be justified for a public layout of such size ; it would have incurred immense cost in time and equipment, but more menacing factors would have been the great additional intricacy (with proportionately increased possibilities of breakdowns and failures) and the dangers resulting from the widely varying starting loads of locomotives under different circumstances. However, the question of incorporating this added realism did not require much consideration, as there are perhaps greater advantages in delays out of sight and the conformation of the trackwork of The Model Railway made this a simple matter ; the automatic sections for the horseshoe (Track D) are in tunnels and of the 24 sections for Tracks A, B, and C, all except two each on Tracks A and B are on the hidden spirals and level section beneath the entrance stairway. For any number of trains up to within one of the maximum per track, the four sections on visible lengths of Tracks A and B are so arranged that a stop on any of them could arise only as a result of unusual emergency, thus permitting 21 of the possible 23 trains to operate on the layout without sudden stopping and starting being seen ; if the twenty-second and twenty-third trains are added, these undesirable visible stops can occur at times at one place on each of the two tracks concerned, but as the full complement of 23 trains is never approached except for special demonstration or test, this result of running more than 21 trains can be ignored.

It may be thought that if 23 trains can be run, the usual total of 9 used for public exhibition may be rather scanty ; alternatively, that if 9 trains give ample life to the visible portions of the trackwork, 23 would provide a ridiculous crowding. Neither surmise would be correct, as the very careful planning of section lengths (which vary widely both on any one track itself and on each track relatively to others) provides excellent results with 9 trains and would not increase the visible service noticeably with the maximum of 23 trains in use ! There would however be a very great change in the number of appearances per hour of each train and in the cases of Tracks A and B, a lapse of some 15 to 20 minutes would occur between the disappearance of a train into the tunnel mouth at the top of one spiral and the emergence of the same train from the tunnel mouth at the top of the opposite spiral ; this increased operational realism could easily be imagined as a great advantage, but experience has shown that it is hardly suited to public exhibition work, as large numbers of the spectators concentrate so much on individual trains that they make a point of concluding that there has been a breakdown even when time out of sight amounts only to a couple of minutes !

The system whereby each train controls the one behind itself will be seen to permit the use of trains on the same track without consideration of relative speeds ; this is clearly essential and something which could not possibly be achieved by any system dependent merely on timing. However, the operational basis adopted would still give a definite sequence for each track if no means of breaking down the regularity were employed ; this led to the designing of the complication shown towards the upper right-hand corner of the track plan, where local Track D cuts across fast Tracks A and B (an arrangement for which there are at least two precedents in this country in prototype practice).

The double diamond introduces hidden control of Track B by Track D and of Track D by Tracks A and B ; a little thought indicates that through its effect on Track D, Track A also has a certain amount of indirect control on Track B. All this is in addition to the full electrical interlocking which is of course incorporated to protect each crossing when a train is on or near it ; safety devices are brought into operation by any approaching train and these are independent of the auto-control sections already described for the running on each track.

Other factors are also involved to increase the breaking down of all semblance of regularity, but it can readily be seen that the different speeds of two or several trains on each track, the varying lengths of the circuits and of the automatic sections on each, together with the interdependence at the double diamond of each of three tracks on one or both of the other two, already introduces such a multiplicity of combinations that consideration of several lesser factors is hardly necessary.

Automatic station stops have of course been included in the operation of The Model Railway and without investigating either the means or the exact results, it can be said that these too are irregular. As can be seen from the track plan, Track D includes a double platform main station and a single platform wayside station ; on each complete circuit of this track a train passes through the main station once in each direction and through the smaller station once in one direction only, thus providing for a maximum of three stops and a minimum of none. Again the absence of regularity is based on quite a number of factors which provide such a variety of possibilities that although stops are frequent, no amount of checking will reveal the secret.

Very frequently spectators jump to the wholly incorrect conclusion that a train stops or re-starts as a result of the passing of a train on an adjacent track ; on the contrary, the basis of the automatic stops is the use, for each of the three platforms concerned, of a Kirdon Automatic Train Control Unit, which is operated by the train it stops and re-starts. In using this unit it was considered advisable to incorporate an additional resistance rail beyond each end of the track controlled and the resultant grading of deceleration and acceleration proved well worth while, the gains in running realism being very great. The two extra resistance rails per unit involved the use of extra wiring and relays for the automatic elimination of the whole arrangement when a non-stop train approaches, but considerably greater complexity concerned several further relays needed to give varying starter signal action for stopping and non-stopping trains and to ensure that once a train has passed a certain control point, changes in any of the

several anti-sequence factors cannot affect the stop or non-stop setting of the circuit until the train on the controlled section at that time has left it. Were steps not taken to prevent it, it would be a common matter for a train to slow down almost to a stop and then leap away at full speed as a result of a change in the circuits controlling absence of sequence, but ridiculous happenings of this nature are prevented by special circuits which cause changes to apply only to the first subsequent train that **enters** the controlled track ; attempts at automatic operation are often spoiled by failure to appreciate this angle and it should always be remembered that full consideration has to be given not only to achieving the initial effects, but to ensuring that changes in circuits cannot affect any train already under the control of a different setting and will only apply to a subsequent train.

The Kirdon Automatic Train Control Units used for the station stops have given excellent service since being installed ; at intervals of several months it has been necessary in each unit to free off the contact points of the thermal switch responsible for breaking the track supply circuit, as constant day-long use eventually causes failure of the points to separate. This is apparently due to gradual pitting of the contacts and ultimate fusion of some minute pinpoint projection on each surface, which results in just enough bonding to prevent separation. Such a development is to be expected sooner or later, but the cure is simplicity itself, as full opening of the adjustment screw and subsequent re-setting removes the difficulty for a further long period ; in any case, the problem is hardly likely to affect the private modeller, whose total use of a unit is less in many years than the use in a few months where a public layout is running all day and every day.

Before leaving the description of the irregular features of the automatic running of The Model Railway, it might be well to say that the steps taken to achieve complete absence of regularity were accompanied by constant checking to ensure that the operational results remained logical and attractive ; careless approach, with concentration solely on the breaking down of sequence, could very easily have led to freak results even more undesirable than clockwork regularity !

Signalling is another feature of the automatic operation of The Model Railway ; for a number of reasons, a full and correct installation would not have been a wise move, but useful effect has been achieved by placing single-arm signals at carefully selected spots. Operation is by the trains, which energise relays, these in turn closing contacts to the signal solenoids ; the signals are standard electrically-operated models from the range by Scale Model Equipment Co. Ltd. and they have given excellent and reliable service throughout. If operated on an A.C. circuit, the recommended voltage must be used, as comparatively slight reduction in this causes the signal arm to chatter, while if wired from a track or other D.C. supply, the sensitivity of these signals to any trifling percentage of A.C. passed by the rectifier indicates pointedly the advisability of absorbing this harmful ripple, a point which will be covered in the next chapter.

It is interesting to note that in the case of each station platform, the starter signal is operated by a non-stop train from a point some distance before the

commencement of the platform, but where a stopping train is concerned, the first switch is automatically made inoperative and the signal does not go "off" until the instant before the train comes to a halt in the station.

In addition to the single-arm signals, one example is included of a post carrying home and distant arms and operating correctly to prototype practice ; this signal was constructed from B & K cast components, which make up into a most attractive unit with a nice action. Electrical operation was arranged by mounting two electro-magnets below the baseboard to give direct downward pull.

This signal is wired in conjunction with a whistle unit and action is as follows :

1. When two sections ahead are clear, both arms rise to "off" simultaneously when a train reaches the operating switch ; the whistle is not sounded and the arms return together to "on" when the train has passed.
2. When only one section ahead is clear, the home arm rises on the approach of a train, but the distant arm remains "on" ; the nearer approach of the train causes two long blasts from the whistle unit and the home arm returns to danger when the train has passed.
3. If, while the home arm is "off" as in the circumstances just mentioned, the train ahead clears its section, the distant arm rises to change "proceed with caution" to "all clear" ; when this occurs, no whistle blast other than any already started is sounded. As in the earlier cases, the arms return together to their "on" positions after the passing of the train.

The next operational feature to be mentioned is the whistle unit to which reference has already been made ; its work in conjunction with the double-arm signal is in fact its most interesting duty, but it also operates as each train on Track A approaches the tunnel mouth leading to the downward spiral.

The whistle unit fitted to provide these sound effects has not up to the time of writing proved entirely satisfactory, becoming barely audible about half to one hour after current is switched on each morning ; as it does not seem that prolonged use should affect the efficiency, it is proposed when time permits to investigate such possibilities as the need for a higher D.C. output or removal of A.C. ripple from the D.C. circuit of the unit.

Pointwork on The Model Railway is operated electrically from the control panel, as standard running does not include many changes from one track to another ; there are however occasions when a good many trains are taken over on the manual controls (as for instance when all trains are brought up to their sidings each day just before closing) and as all experienced modellers will appreciate, the handling of half-a-dozen trains at once can call for very rapid actions. The usual use of a lever frame carrying contacts for operating point motors would hardly offer the best opportunities for the extreme rapidity of action and accuracy of selection needed at busy times on a layout of such size and the use of two push-button switches for each point motor was adopted ; exceptions occur where two point motors work together, as in the case of a crossover, one pair of switches serving to control the two motors.

Of each pair of switches, one switch sets its point for main route and the other for secondary ; beside the main route button is a red indicator light and if this is illuminated it shows that the point concerned is set for the secondary route and also reminds the operator that the button beside the light is the one which must be pressed to return the point to main setting. The indicator lights, together with a layout of switches similar geographically to point positions, cuts work to a minimum and makes fast and accurate control of a number of trains astonishingly simple.

On Track D the double junction shown towards the lower left-hand corner of the track plan is train-operated in addition to being wired for operation from the control panel ; after a train has entered the return loop, the locomotive energises a relay which in turn operates the point motor. This is obviously necessary, as the train is bound to require a reversed point before it can emerge from the return loop, while it also adds a little variety by causing alternate trains to travel clockwise round the outer loop and anti-clockwise round the inner loop.

It is not unusual for this double circuit to be mistaken for a reverse loop, but a glance at Diagram 9 will show that the device employed is nothing more than the imposition, one upon the other, of two alternative routes from X to Y ; the result is undoubtedly most effective and to some extent baffling at first glance.

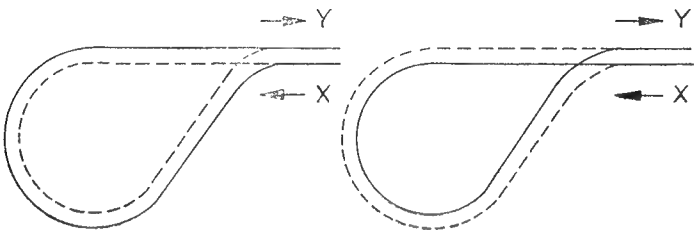


DIAGRAM 9

Zenith Point Motors were installed throughout and one of these has ample power for the operation of both ends of a crossover, but it was felt that rodding should be kept to a minimum, so no attempt was made on The Model Railway to control any crossover from one motor, although a single unit was fitted for the two sets of blades of the double junction. The Zenith Point Motors have given hard and reliable service at all times, but it was found advisable to improve the locking qualities ; a slight tendency to bounce unless perfectly adjusted was wholly overcome by the simple expedient of removing the baseplate of each motor and fitting three interlaced ERG OO coupling springs in place of the somewhat inadequate spring used originally by the makers. Any enthusiast with the original Zenith pattern of motor still in use will find this measure very easy to carry out and well worth while, though in all fairness it must be said that the motor has since been redesigned.

The later advent of the Rogerson Positive-locking OO Point Motor, which did not appear until some time after completion of The Model Railway, introduced a new pattern and led to the fitting of one for exhaustive tests, from which this make too emerged with highest honours. It has been stated that this book will give praise where praise is due, but it is not a purpose of these pages to boost one good item against another purely for trade purposes ; rather is it the aim to give an unbiassed statement of fact and in the case of Zenith and Rogerson Point Motors it can be said that the purchaser of either will be completely satisfied and must make his choice on such points as personal preference, suitability of design for the site concerned and any other factors which may be involved in any particular instance.

Live point frogs are used throughout on The Model Railway, change of polarity being by means of ex-G.P.O. changeover switches operated mechanically by the point motors ; each switch also incorporates an additional pair of contacts which serve perfectly for the appropriate indicator light on the control panel. A long frog is used in the case of each trailing point, because although it causes a momentary short circuit if a train runs on to the frog when the point is inadvertently set wrongly, the immediate stopping of the train forms a very useful safety device ; were it not for the use of the extra contacts of the changeover switches being used for indicator lights, these could of course be employed to provide a dead section behind an incorrectly set point, thus avoiding the momentary short circuit which can occur when the frog itself is used for a similar purpose.

CHAPTER VI

OPERATIONAL CAUSES

In the preceding chapter are details of what *happens* in the way of automatic operation on The Model Railway, but the means of *achieving* this can be dealt with far less explicitly, as any attempt to explain it fully would require a separate volume devoted wholly to involved text and hundreds of diagrams on this single subject ; where a matter is likely to be of value to modellers, every effort will be made to deal comprehensively with it, but as it is felt that fully automatic operation is undesirable for a private layout (and would in fact be responsible for eliminating one of the leading pleasures), failure to explain here the precise means by which it is achieved for The Model Railway is not an important point.

The best starting point is the matter of power supply ; this is from A.C. mains through an ERG Power Unit constructed specially (but from standard components) to provide higher output and a greater number of voltages than are required by the ordinary user. The full specification of outputs, each of which is entirely independent of the others, is as follows :

Purpose	*Supply*	*Maximum output*
Forward running	12 volts D.C.	8 amps
Reverse running	12 volts D.C.	8 amps
Point motors	20 volts A.C.	3 amps
Relay magnets	24 volts D.C.	3 amps
Indicator lights	3 volts A.C.	12 amps

For the D.C. outputs, selenium rectifiers are used, but the A.C. ripple which inevitably remains is eliminated in the case of forward and reverse track supplies by the use of a battery float in each side of the circuit, provided on The Model Railway by Exide Type DMG 2v. cells in two banks of six each ; although these cells may not in all quarters be viewed as ideal for the task imposed on them, practical results have shown that they give long and entirely satisfactory service and provide a very economical means by which the modeller can obtain from his power unit the twin 12 volt outputs of pure D.C. which are so essential for the best and most trouble-free running. Since the battery floats were inserted in the supply, the behaviour of locomotives on The Model Railway has certainly improved, though largely as a result of the phenomenal reduction in wear and tear, which gives the added attraction of very great decrease in maintenance requirements ; this experience is worth a lot of thought !

A considerable percentage of the A.C. ripple passed by a rectifier can be eliminated by the use of a high capacity low voltage electrolytic condenser instead of a battery ; naturally this course is a great deal more economical and results are good, but a battery float is the ideal method, with the additional advantage

of coping with fluctuations in mains voltage. The insertion of batteries or condensers in an existing circuit is simplicity itself, as will be seen from Diagram 10 where a common potential system is shown ; for a single output power unit the battery or condenser is of course wired across the two output wires of the rectified supply, but in all cases where condensers are used, it must be remembered that the type mentioned is polarised and must therefore be wired positive to positive, just as in the case of a battery.

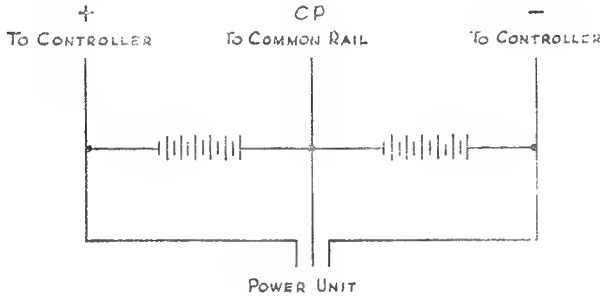


DIAGRAM 10

Electrification of The Model Railway is of course on the two-rail system and on the principle of common potential (perhaps better, but somewhat incorrectly, known in model railway circles as "split potential") ; as a result, one running rail is bonded throughout the entire layout, in this case the choice being the right-hand rail as viewed facing the usual direction of travel. This rail is used also as the common return for all the varying outputs of the power unit, each of these being maintained as an independent circuit electrically by having its own feed wire beneath the baseboards.

The use of the bonded rail as common return for all circuits is merely for convenience in the case of point motor and indicator light supplies, but this is not so where current for relays is concerned, as the course adopted does away with the need of mechanical switches where train-operation is arranged ; it was felt that electrical impulses would prove far better for all control than would mechanical switches, the latter not only being troublesome to design and construct in unobtrusive form, but subject to the need of delicate and frequent adjustment, thus increasing the maintenance requirements and introducing inconstancy of reliability.

With the right-hand rail as the common return, all track sectioning is obviously by breaking the left-hand rail, whether the sectioning concerned is on the main lines and under automatic control or on sidings and loop lines, where control is by on-off switches mounted on the master control panel. In addition to these manual switches for cutting out lengths of track, sectioning is extended throughout the layout to speed control ; a total of fourteen Shenphone C.7 Controllers gives extreme flexibility and makes it an easy matter to pick up any

train on manual control at a moment's notice. The Shenphone C.7 deserves full marks in every respect, as it gives a nice delicacy of control and has proved itself trouble-free and able to stand up stoutly to a very arduous life.

The right-hand rail, although used as common return for all circuits and therefore bonded throughout the entire trackwork, serves a very important purpose in connection with the train-operated auto-control, as it incorporates the switches by which the relays are actuated ; these switches are simple in the extreme, as each consists of nothing more than two cuts in the rail, approximately one inch apart, with a bonding wire to bypass this short section to maintain electrical continuity for the rail as a whole and a feed from the one-inch switch rail to the relay associated with it.

(It might be noted that the need of scores of these double cuts was considered when make of track parts to be used was reviewed and it was obvious that ERG Track would stand up perfectly to a treatment hardly calculated to strengthen the rail concerned, particularly where complicated switching may necessitate the grouping of quite a number within a comparatively short length of rail. With every sleeper held securely by its four track pins, each isolated switch section has three soldered joints, not only giving considerable strength, but allowing for the soldering of a feed wire to the central joint without upset to alignment or level, the section of rail being held securely throughout this operation by the two end joints ; alternatively, bonding and feed wires can be soldered in position before the rail is cut. All cuts should be made as required after the track has been laid, the blade of a Junior Metal Saw making short work of this job ; to avoid drag or vibrational damage, particularly at the instant of parting, it is recommended that prior to sawing, a panel pin or track pin be inserted on each side of the proposed cut, the rail being soldered to the pins, as illustrated in Diagram 11).

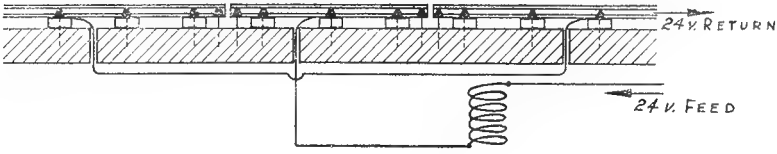


DIAGRAM 11

Diagram 11 indicates how simply an impulse is passed to the relay to be operated ; the wheels of an engine passing over the switch close the circuit momentarily and the armature of the electro-magnetic relay concerned is pulled over. A momentary impulse of this nature does in itself do no more than flick the relay over for an equally short period, but the incorporation of electrical locking, which comes into action instantly with the closing of the armature, maintains the electro-magnet in an energised state until the locking circuit is broken, a momentary impulse again being all that is required.

Viewing this in practical terms based on Diagram 12, it can be seen that a **momentary** impulse resulting from a locomotive passing over Switch A energises

Magnet 1 and closes Contacts X ; instantly, through Contacts X and Y, Magnet 1 becomes fed direct from the magnet power supply and therefore **remains** energised. When the train reaches Switch B, which may be a very considerable

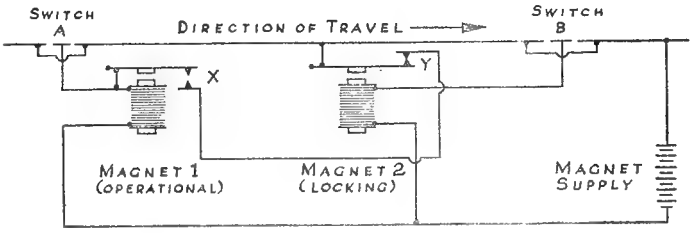


DIAGRAM 12

distance ahead, a **momentary** impulse energises Magnet 2 and Contacts Y are separated ; this cuts the direct feed to Magnet 1, Contacts X open and although Contacts Y close again immediately, the direct circuit remains broken at Contacts X.

Magnet 2 is used solely for locking Magnet 1 and it is therefore to the latter that additional make or break contacts must be fitted for whatever operational result is planned. The energising of Magnet 1 may be required to break the supply to a track section, in which case the additional contacts are wired into track current, or it may be required to make the circuit to a signal, when the extra contacts are wired into signal current, but whatever the objective, it must be clearly understood that Contacts X are solely for locking the magnet and additional contacts used for operational work must be fully insulated from them.

Every aspect of the automatic operation of The Model Railway is founded on variations and combinations of the basic unit illustrated, many of them in complex interlocking banks to provide varying results under varying conditions. Fortunately the task of fitting and wiring was greatly eased by the discovery of a batch of ex-R.A.F. unused starter magnets which could not have been more suitable had they been designed for the work; nevertheless the task was formidable enough and by the time it was finished the layout included 170 relays and over 7,000 feet of wiring.

The first paragraph of this chapter pointed out that fully automatic operation is undesirable in the case of the private layout, so it is not suggested that this should be attempted, but there are many circumstances in which limited use may be of value and interest ; any reader who wishes to introduce some such development can tackle it in the knowledge that in the foregoing paragraphs is included every fundamental fact he requires and that as previously mentioned, the entire automatic system of The Model Railway was developed from the details which have now been given.

At this juncture it might be pointed out that it has been by no means uncommon in the past to say of two-rail operation that it is not a practical proposition and even nowadays this idiotic comment is still heard at times ; apart from The Model Railway with its heavy daily service, there are thousands of private two-rail layouts giving great satisfaction to their owners and any would-be modeller who comes across adverse criticism of this most realistic of all approaches to railway modelling can put it down to the jaundiced outlook arising from complete ineptitude or such laziness as prevents any real effort being made. It has also been said very frequently that two-rail operation has the serious disadvantage of being unsuited to track circuiting ; what has been written here of the automatic operation of The Model Railway cannot fail to convince the most sceptical that this view is equally ridiculous.

These two examples should make it clear that in railway modelling, as in everything else, it is unwise to accept from other than a highly reliable source any statement of alleged **negative** fact ; anyone, whether beginner or expert, may be in a position to put something forward as a **positive** fact because he has done it or has seen it done, but beware the individual whose fancy runs to saying that this, that or the other **cannot** be done . . . unless he knows his subject very thoroughly, his statement may be blown wide open !

CHAPTER VII

THE INDICATOR PANEL

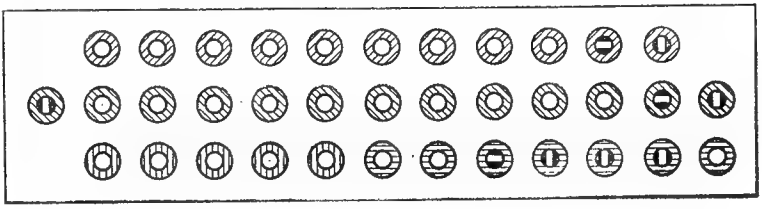
One visible feature of The Model Railway not really intended for public interest has attracted very considerable attention ; this is the indicator panel designed to show just where each train is, how the circuits are reacting, whether everything is in order and so on.

The thirty-one secondary relays used for direct control on the indicator lights are wired from various master relays responsible for major operational results on the layout ; for convenience, the secondary relays are mounted on the board carrying the indicator panel, but it is this panel alone which is of real interest and the relays can be dismissed with the comment that they have no function other than to open and close the circuits to the 2.5 volt bulbs used behind the coloured lenses of the indicators.

The panel carries thirty-six lights ; these include four different colours representing the four main tracks as follows :

Track A	GREEN
Track B	YELLOW
Track C	BLUE
Track D	RED

It will be recalled however that in connection with the main junction, sections on certain tracks come at times under the control of trains on other tracks ; for example, a light put on by a train on Track A may indicate control of a section on Track D and a means of clarifying this inter-track action was necessary. Each lens was therefore surrounded by a ring painted in the colour (as per the table given) of the track **affected** by the light, while the light itself is in the colour of the track **responsible for its appearance** ; the colour of the ring thus indicates



GREEN RINGS
YELLOW RINGS
BLUE RINGS
RED RINGS

DIAGRAM 13

on what track the **result** occurs and the colour of the light within the ring shows on what track the **cause** takes place. In addition to the dual colour code, inter-track combinations are distinguished by vertical or horizontal bars instead of the circles used to denote normal track sections ; these points and the actual layout of the indicator panel are illustrated in Diagram 13.

The reaction of lights with circular lenses is readily explained ; each represents an auto-control track section and the presence of a train on any one of these causes illumination of the appropriate lens. The number of round green lights showing on the panel therefore indicates the number of trains on Track A and the position of each ; similarly, the number and positions of trains on Track B are seen from the round yellow lights and so with Tracks C and D, while the constant movement of illuminated circles from right to left along the panel provides an accurate guide to the progress of the various trains along their respective tracks.

The case of the bars of light could not be explained so fully without a very complete description of the entire system of inter-track control used to break up regularity of sequence and to protect the double diamond crossing ; such a description, which would be difficult to compose and far from easy to follow in cold type, would not have any great appeal to the majority of readers. The basis has already been covered in the explanation that a bar of light indicates that a train on one track has operated a control affecting a different track and nothing need be added on this score unless it be the comment that a vertical bar shows that a halt section has been introduced on the track denoted by the colour of the ring surrounding the bar ; for instance, a red (Track D) bar in a yellow (Track B) ring indicates that for some purpose a train on Track D has cut the supply of current to a particular section of Track B and no train on Track B can therefore proceed beyond this dead section until the train on Track D has progressed as far as the switch releasing the arrangement.

To conclude this chapter it might be said that the indicator panel has tremendous practical value and to those familiar with the principles, construction and operation of the layout and the habits of each train in service at a particular time, this feature conveys at any instant a detailed story from a single glance, even though a dozen or a score of trains could be involved ; not only does it cover the positions and behaviour of the trains, but shows immediately the slightest fault in any key detail of the automatic control. In short, this fitting is no mere fancy ornament flashing coloured lights on and off haphazardly, but one as valuable as a combined radar and X-ray installation.

CHAPTER VIII

LOCOMOTIVES AND ROLLING STOCK

It would be out of place in this book to introduce anything in the nature of constructional hints and guidance on the subject of locomotives and rolling stock and a review of what is used on The Model Railway is much more appropriate ; such a review must of course be general and it will be understood that no assurance can be given that specific items mentioned here or seen during a visit to the exhibition will necessarily be in service on all occasions. Changes in stock operated or included in reserve may occur for many reasons ranging from moves to provide variety to the sale of some particular item or the advent of a new production worthy of inclusion.

When The Model Railway was first opened to the public on 4th June 1949, it was in full working order (apart from certain operational refinements which were added soon afterwards), but no start had been made on scenery, as it was felt that the public would find considerable interest in watching the development of scenic effects and seeing what methods were used to achieve them. As it transpired, this experimental policy was very popular and brought many highly appreciative comments, but reference to it is made here simply because it makes clearer the programme adopted in the first place with regard to locomotives and rolling stock. Before the opening of the layout, time pressed heavily and necessitated the assembly of a suitable stud on the quickest possible basis, then the task of building a wider variety of stock had to be set aside for many months to permit maximum effort on scenic effects, which were a top priority from opening date until completion. If this situation is considered, the early lack of variety and the comparatively few changes during succeeding months are not difficult to understand.

Locomotives

The initial stud consisted entirely of 0.6.0 tank engines, though a little variety was provided by the running of a pannier tank amongst the more numerous parallel and tapered boiler types then in service. With the exception of the pannier tank, the engines were built from the Stewart-Reidpath cast bodies, those time-honoured friends which never become outmoded, never look out of place whatever the type of layout and build up so easily into maids-of-all-work with maximum adhesion for size.

Each chassis had fixed driven axle, with springing on front and rear axles, considerable time being saved at an important juncture by the omission of full springing ; all subsequent models were of course sprung on every axle and this is a standard feature of specification for locomotives on The Model Railway.

Zenith Mark IV Motor Units provided the very satisfying power of the original engines and when it is remembered that each full circuit of Track A, B

or C includes a 1 in 40 climb approximately sixty feet in length, largely on the curve and probably involving at least one re-start, it will be appreciated that constant running hour after hour and day after day calls for exceptional qualities. These original motors have of course been overhauled from time to time, with occasional replacements of commutators and, more rarely, armature bearing bushes, but it speaks very highly of the products of The Zenith Model Co. Ltd. that at the time of writing they are still in daily service, despite the fantastic number of actual miles each one of them has hauled its train.

Before reviewing later developments in locomotive stock, it might be well to explain that the layout is largely representative of some more remote county where the bulk of traffic is local or cross country in nature. Apart from wishing to avoid the dwarfing effect on any layout of too many long trains running at suitably high speeds, it is felt that short and medium trains with appropriate locomotives are on the whole more fascinating and more suited to the scenery than would be numerous heavy expresses drawn by giant engines ; the usual display therefore includes only one or two main line trains handled by express locomotives, the remaining service being provided by a variety suited admirably to less glamorous duties. Incidentally, need it be said that each train from slow goods to express passenger is maintained at a speed appropriately scaled to prototype practice for the service concerned ?

During the first year of operation the only additions were a Southern Electric four-coach train, an L.M.S. Class 4 (Fowler) 0.6.0 tender goods engine, a Southern "West Country" 4.6.2 and an L.M.S. "Royal Scot" Class 4.6.0 ; the history of the last-mentioned can be ignored, as the locomotive and its coaches were sold to an admirer not long after the train was put into service.

Some comment is needed in the cases of the Fowler and the Southern Electric, as these brought into service the first Romford power units used on The Model Railway. A fully sprung chassis built for the Fowler (the body of which was made from a Hughes kit) was fitted with a standard Romford Series IV enclosed gearbox motor, but very soon afterwards the 30-1 gearing was converted to 40-1 by the use of a Zenith worm and worm wheel, which give a centre to centre measurement almost identical with the Romford 30-1 gears and thus made it possible to carry out this purely personally desired conversion without major interference with the existing sideplates of the gearbox, although slight modifications were of course required.

The Southern Electric train, a conversion from Exley suburban coach bodies, was powered by a Romford Series III Motor Bogie ; no modifications were made in this case except the fitting of the special collectors used throughout on the layout, a point which will be dealt with more fully a little later on.

The colossal mileage of the original Zenith Motors has not yet been reached by the Romford units owing to their considerably later advent, but the motor unit and motor bogie have each covered over 500 actual miles up to the time of writing ; power and performance under the trying conditions previously explained have been consistently excellent and there is nothing to indicate that they will not continue to be equally satisfactory for a very long time to come.

One rather interesting addition to the engines so exhaustively tested on The Model Railway, an American 0.4.0 switcher assembled from a Trix kit, has not yet been mentioned at all ; the omission hitherto has been deliberate in order to bring rather special attention to a commercial job turned out by quantity production methods and which must therefore be given particularly high credit for its fine performance under conditions for which it was certainly never intended. The kit concerned is the first of the Trix 2-rail outfits with wheels suitable for scale track and permanent magnet motors for 12 volts D.C. ; the detail of the diecast body parts is very excellently produced, the kit assembles very smoothly and the already assembled chassis incorporates a power unit and transmission giving ample power and delightfully flexible control. As no alterations were made to a kit taken from stock other than the fitting of the special shoes to which reference has been made and the addition of extra weight to counter the upward thrust of these collectors and to procure maximum adhesion for the trying gradients, the makers are to be congratulated on turning out a standard and reasonably priced outfit capable of facing up to the gruelling existence provided by permanent exhibition work.

(Since this text was written, the locomotive stud has been increased by the addition of an L.M.S. "Coronation" 4.6.2 in its original streamlined form and a G.W.R. Class 61xx 2.6.2T ; these are sprung throughout, with self-centring bogies and ponies actually carrying weight, and are heavily weighted to give maximum adhesion. . . . a practice considered essential despite the existence of other schools of thought !)

More than one reference has now been made to the special collectors used on locomotives on The Model Railway and this has probably given rise to a certain amount of speculation on the part of some readers. Collectors were originally fitted to wipe on wheel treads, but these were found to have several disadvantages and were soon replaced by hard brass wires bearing on the insides of tyres, this pattern giving very reliable results.

There is however a very important proviso, as a considerable share in the reliable and efficient running of The Model Railway must be credited to the addition of two watch spring shoes under each side of every engine ; these shoes bear on the two running rails and serve the double purpose of keeping the track clean and ensuring reliable operation of the switches responsible for the automatic working of the layout. The task of cleaning the rails of The Model Railway could have been a major problem and as dirty rails lead to dirty wheels, keeping the latter in good condition might have proved even more trying, so it says a great deal for the special shoes that neither rails nor wheels have ever been cleaned since the layout was opened, thus not only eliminating work which might well have required many hours every week, but at the same time ensuring permanently the smooth running which comes only from clean wheels on clean rails. As a side issue it is rather interesting to note that the shoes frequently maintain the rails in a polished condition and at other times permit a dull dark surface which neither interferes with electrical contact nor becomes transferred to wheel treads, although it can be wiped off with the finger tip ; it is also interesting to note that the perfect results achieved are in circumstances where more than the usual amount of dust is present on frequent occasions.

The reliable operation of auto-switches is as important as reliable current collection ; wheels alone are reasonably efficient at low and moderate speeds, but cannot be considered wholly dependable and they fail fairly frequently to operate switches at higher speeds. On the other hand, the shoes described are completely trouble-free and operate the switches reliably under all conditions.

Coaches

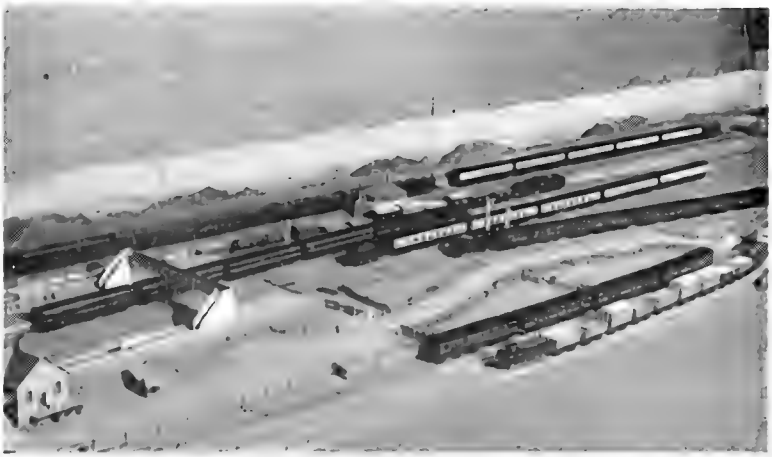
With the exception of four handbuilt fully detailed S.R. suburban coaches which were already available, all initial passenger stock was in the form of Exley bodies mounted on G & W ball bearing sprung bogies ; both the bodies and the bogies are to connoisseur's standards and are too well known to require further comment. At a later date the introduction of CCW Coach Construction Units led to the addition of trains built from these very cleverly conceived and excellently produced parts which enable the veriest novice to construct a wide variety of body types with the minimum of trouble and the maximum of satisfaction ; here too the bogies used were of the G & W ball bearing sprung variety.

All coaches on The Model Railway run on ERG nickel-plated solid brass wheels, the use of all-metal wheels for two-rail being a tremendous boon made possible by the fitting of Peco-Insulaxles. It does not seem likely that too much praise can be given to this outstanding development ; insignificant as an axle appears in comparison with the whole subject, the Peco-Insulaxle provided the perfect solution to a very vital two-rail problem which had not been solved previously in any fully satisfactory manner suited to all conditions.

Goods Stock

In this direction too there was the need to save whatever time was possible ; only a few detailed vans and wagons were available, these having been built previously from ERG "Precision" Card Parts (as described in the ever popular and record breaking textbook "Cardboard Rolling Stock and How to Build It"*), but this small number of vehicles was very rapidly brought up to adequate figures by the use of ERG "Master-piece" Parts for OO rolling stock, a range of pre-fabricated components offering wide variety and quick, easy assembly of very beautifully detailed wagons and vans.

* Published by ERG (Bournemouth) Ltd. 2s. 6d. ; by post 2s. 9d.



CHAPTER IX

SCENIC EFFECTS

It cannot be said that any one feature "makes" a model railway, because what provides finish in the eyes of one enthusiast may not be the choice of another, owing to variations in tastes and interests ; there is also the fact that a layout consists of so many features, both seen and unseen, that even the most definite preferences would certainly be of little interest if separated entirely from their accompanying circumstances. However, it will undoubtedly be agreed that for a public exhibition planned to give all-round pleasure, the realism and finish of the scenic effects is a most important aspect of the display.

For The Model Railway it was decided that the maximum impression of space and depth given by countryside scenery offered the most attractive solution and also provided the best circumstances in which to operate most of the trains within the rather attractive 30 to 50 scale miles per hour speed range.

It has already been explained that the layout includes two stations ; the main one serves some imaginary community which does not appear in the scene and is also the junction for the smaller station and goods depot on the single line track serving a country town, this small town forming a very attractive part of the large corner shown to the right of the entrance stairway at the foot of the track plan. In the rather smaller corner to the left of the stairway, a lake in pastoral surroundings has a background of rough mountain scenery beneath which runs a tunnel ; a stream bed winds steeply down from behind one mouth of this tunnel, passes through a culvert under the tracks and meanders down to the lake. An electrically driven pump is fitted beneath the baseboards to lift water from an outlet below the surface of the lake to the hidden "source" of the stream, but it transpired that the culvert and one of the deliberate bottlenecks in the bed of the stream caused an intermittent tendency to overflow ; this fault will be rectified when a suitable occasion arises, but it has not been possible to tackle the rather difficult alterations up to the time of writing.

The photographs included in this book give a better impression of the general treatment in regard to scenery than would any addition to these brief references to one or two special features, but it ought to be said that as much care and patience were given to the scenic side as were lavished on operational aspects such as trackwork and automatic control, a point which can be appreciated from an examination of the photographs. All too frequently, and especially in the case of public exhibition layouts, scenic work is scamped, and although there are many modellers who achieve magnificent results, there are even more who decide that the roughest of rough efforts will suffice ; it may be that only a general impression rather than a really natural scene is required and to this there is no objection, but such work as is undertaken should be done well and whether

a job is to be fully detailed or only broadly outlined ought not to be taken as a guide to the workmanship put into it. Conversely, quite a good job may merit less praise than one that is frankly poor in effect if the latter has received the more conscientious workmanship and the modeller should be less worried about the stage to which his ability has developed than about the sincerity put into the effort and the amount of determination he has to make each better than the one before.

The final and perhaps most useful purpose of these pages is to provide an analysis of each type of scenic feature on The Model Railway, with very brief notes on the materials and processes used to achieve it ; it is not suggested that this represents an attempt to give full instructions or to mention all the minor problems which arose, but it is hoped and believed that even such a sketchy treatment will open up new approaches by providing here and there an idea or basis not spotted previously by some readers.

Throughout the headed paragraphs, any mention of paint on to which surfacing material has to be sprinkled refers to glossy varieties of the household type ; cheap paints are frequently the most suitable, as they have their full share of glutinous qualities and seldom form a skin rapidly enough to prevent adhesion of whatever surfacing material is applied. Generosity of application varies according to finish required and material to be added ; materials used on The Model Railway in this connection included bird sand, ERG Ballast, cement powder, concrete dust (best obtained by the vigorous use of a hard brush on any concrete floor which has not been treated with any of the special preparations for preventing dust or sweating), fine granulated cork and cork flour . . . and of course Modelcraft Flock Powders in green and earth brown, without which the scenic modeller should certainly not start work.

For simplicity, the following analyses are given in brief instructional form, but it will be understood that they still convey what was actually done during the construction of The Model Railway.

Hills and Cliffs (tunnelled)

Build very rough, but strong and rigid stripwood framework with irregular peaks and levels, covering it roughly with suitable pieces of cardboard tacked in position ; over tightly crumpled paper lay pieces of rag (hessian being the ideal type of material) and paint generously with cement mixed to a fairly liquid state. To add realism to a cliff face, ensure that rag is not drawn taut and throw a sprinkling of bird sand into damp cement. For general surfacing, wait until cement is thoroughly dry and paint with green and brown paints, covering generously all over with flock powder ; use judgment in application of green (smoother ground), brown (gullies, bare ground, etc.) and mixed patches (broken ground). Surplus flock powder should not be touched until paint is completely dry, when it can be brushed off very lightly, but as removal in this manner is liable to be a ticklish problem, with much loose powder simply settling elsewhere, the ideal method is to go slowly and carefully over the whole area with the extension nozzle of a vacuum cleaner, the nozzle being held a quarter of an inch or so above the surface to be cleared.

To avoid considerable monotony, notes in the foregoing paragraph on giving attention to varying any particular surface and on removal of surplus surfacing material when paint is thoroughly dry are not repeated under each feature to which they apply, but they should be borne carefully in mind.

Hills and Cliffs (not tunnelled)

Construct approximate contours with fine wire mesh, building a stripwood framework for this if necessary. Rub cement into mesh and apply more at once to give a substantial thickness, working the cement into its final contours as it sets. Where cement will meet baseboard, "key" it adequately by working it over large-headed tacks or bent nails previously inserted into the timber. Add surfacing in green, brown, etc., as required, cliff faces being left in natural finish, but with ledges and irregularities suitably touched with paint and flock powder to represent the grass and weeds invariably in evidence in such places.

Grassland

Paint surface and cover with green flock powder for lush field, but with less even green and brown for more usual land ; for rougher surfaces, work lumpy material into a generous coat of paint before adding flock powder, ERG Ballast being useful in this direction. Where more applicable, lay uneven surface of cement over keying nails ; for rocks and boulders, select from the lumps usually found in cement powder and lay the chosen pieces on the wet cement surface, moistening each until bonded within itself and to its foundation.

Ploughland

To a generous coat of brown paint add a thick layer of ERG Ballast ; after removal of surplus, wash with thin brown paint if it seems advisable to alter the shade of the final surface. Ensure realism by including adequate width of greenery between cultivated area and fence or hedge.

Fences (wire)

Drive into baseboard suitable nails from which heads have been removed ; add wires halfway down and just below tops by giving each wire one turn round each nail and stretching tautly to next nail. Solder wires to nails at each turn of wire ; paint suitable colour with matt paint.

Fences (wooden rail)

Into tight holes drilled in baseboard, drive posts of 1/8in. square stripwood, smearing the end of each post with glue before insertion ; glue two (or more) rails of 1/16in. square stripwood along outsides of posts and secure in position with weights placed alongside until glue has set. As posts are seldom in a straight line, the lengths of stripwood for rails should first be fractured inwards or outwards at the points where they will be glued to the posts. Paint with thin brown wash.

Fences (weatherboard)

Insert posts of 1/8in. square stripwood as for rail fence ; cut a width suitable for fence height from 3/64in. or 1/16in. balsa wood and score lightly on each side with sharp knife. Glue to posts, preferably in one length, but as separate sections between adjoining posts where angle between posts is too great for fractural

methods ; bear in mind that weatherboarding usually hangs clear of the ground. Add horizontal rails near top and bottom of inner face by gluing 1/16in. square stripwood to balsa fence, the rails being cut to length to fit snugly between posts. Paint with thin brown wash.

Hedges

Cut a strip of suitable length and width from household wire wool, Brillo Cleanser being an ideal brand for the purpose ; apply a very generous strip of glue or balsa cement to the baseboard along the root line of the proposed hedge and place the strip of wool in it edgewise, working the hedge well into the adhesive. Leave to dry and then work moderately thin glossy brown paint into the wire wool ; sprinkle with green flock powder and a dusting of brown. To apply the paint to the wire wool it is usually necessary to press the hedge over on to the baseboard, first to one side and then the other, but this need not cause concern, as the wool can be worked into a suitable shape and position after painting and before application of flock powder ; as the paint dries it stiffens the hedge and maintains it in the desired formation.

Note that here and in any other cases where glue is required to secure a feature, the glue should not be applied to a surface which has been treated with flock powder, dust, cork, etc. ; if the surfacing is already present, scrape it away where the glue is required to adhere.

Trees

These have proved rather a problem for modellers in the past, but very attractive realism can result from the use of various plants suitably treated. The subject is wide and can be discussed only briefly here, but the examples given are a guide to the main points to be studied in the modelling of any particular species ; four methods as used for trees on The Model Railway are outlined.

1. For tall slender evergreens, select suitable straight shoots of gorse ; trim away all spikes from the bottom of the stem to form a short length of trunk free from branches and foliage and cut all long primary spikes to the length of adjacent secondary growth. Dip into glossy paint, drain off surplus and cover thoroughly with finely granulated cork ; hang up by trunk or stand tree in drill hole until completely dry. Then dip into thinner paint and sprinkle with green flock powder suitably pre-darkened to evergreen shade by mixing well with brown flock powder ; set aside until dry.

2. For poplars, choose suitable heads of cotton grass ; spray with lacquer, being very careful to get this protective covering right into the foliage as far as the stem. When dry, spray with matt green paint of the right shade.

3. For general types, obtain a good supply of heather and select carefully any complete heads on thick stems, suitable in general conformation as they stand ; in addition select small sprigs, arrange together in attractive forms to give good heads and adequate trunk thickness and bind trunks closely from end to end with fine wire. Trim heads finally and dip into glossy paint, drain off surplus and provide body by sprinkling well with finely granulated cork ; allow tree to hang or stand until dry, then dip into thin brown paint and sprinkle suitably with green flock powder. Finish bound trunks with matt brown paint.

This method lends itself to very wide variations in style and appearance and by judicious choice of shapes and finishing powders, variations in paint viscosity and light or heavy application of cork granules, trees of many varying species can be developed, from mountain ash to oak and lime to copper beech.

4. Amongst rock plants are one or two specimens with hard stems and tiny leaves ; find suitable sprays and bind together to give attractive head and trunk. Spray thoroughly with protective lacquer, touch in leaf clumps with matt paint of shade to suit tree concerned and finish trunk with matt brown.

It is appreciated that these notes on trees leave a great deal to be learned by the modeller himself, but they do provide the essential basis and from this it will readily be found that a few experimental efforts teach more on this subject than can be put into print.

Roads

Different surfaces are obtained by varying the amount of paint applied to the site and by the use of different surfacing materials ; detailed examples would, as in the case of trees, be of less value than practical experience, but the following points may prove useful.

Apply glossy paint generously to the site unless a very smooth final surface is required, when the paint should be used more sparingly ; cover generously with the chosen surfacing and allow paint to dry thoroughly before attempting to remove surplus. For a dirt road, brown paint should be covered with several light sprinklings each of brown flock powder, cork flour, concrete dust, etc. ; concrete dust on black paint results in tarmac, rough cork flour well mixed with cement powder can be used on brown paint for rolled sandstone and cement powder on grey paint gives a concreted surface.

In all cases except where flock powder is used, road surfacing materials can best be applied from a salt cellar, but it must be remembered that separate sprinklings of varying powders give very different results from a single application of pre-mixed materials. In most cases it is advisable to avoid a smooth final finish, as an examination of roads soon confirms that surfaces broken by patches and changes in materials are the rule rather than the exception. Attention to conspicuous detail (such as white guide posts at the bends in a country road) more than repays itself, even when full detail is not required.

* * * * * *

Although some of the major scenic features of The Model Railway have yet to be considered, they can be dealt with very rapidly as their nature is such that little is to be gained by doing much more than review the various proprietary items used. There is however one important reminder which must not be omitted ! Buildings, bridges, fence posts, walls and a dozen other features, however good in themselves, cannot produce a sense of realism unless they look as though they are built into their sites ; a trace of grass along the foot of a wall, a climbing plant of paint and flock powder linking house and garden, the disguising of straight lines where buildings meet natural land . . . these are the touches that **make** a scene.

Railway Buildings

Anorma Kits, of which there is a wide range in railway and other OO architectural styles, were used for the station buildings and footbridge, the goods depot and the two signal cabins ; in place of those supplied with the kits, special platforms to suit the sites were built from $\frac{3}{4}$in. square stripwood and 1mm plywood and the standard double track footbridge was lengthened to span four tracks by the simple substitution of longer strips of balsa wood for the upper floor and plate girder sides. There is certainly a use on every layout for kits from this excellent range, which offers attractive modern styles in a form very easily built without special skill or equipment.

Romford 12in. lengths of station fencing, a beautiful reproduction in hard fibre of the paling type fence used so widely on station property, made it unnecessary to employ tedious methods to construct fencing of the correct type for the rear edges of the station platforms.

Bridges

The attractive skew girder bridge shown in one of the photographs comprises vertical and overhead girders made by soldering Brooks' OO channel sections back to back, top and sloping end plates of 3/16in. x 1/16in. brass strip and diagonal ties of ERG Gauge O boiler bands. Many modellers do not realise how easily and economically such a pleasing feature can be built.

The brick single track rail bridge and the grey stone road bridge, of which there are two views amongst the photographs, were made from odd pieces of hardboard, balsa sheet and plywood, covered with Anorma brick paper in the one case and Modelcraft stone paper in the other. Such bridges are most effective, yet cost only coppers and are so simple to build that nothing specific can be said about construction.

Country Town

With the exception of the two cottages beside the level crossing gates in the background of each of the two views in this book and the double cottage in the centre foreground of only one of the photographs, all the buildings of the country town were built entirely from the wonderful card cutouts produced by A. W. Hambling & Co. from originals designed and executed by Mr. R. G. Vacy-Ash. The realism shown in the photographs speaks for itself, but this opportunity cannot be allowed to pass without the highest tribute being paid both to the designer and the producers of "Bilteezi" Super-Scale Building Construction Cards. Unlike some cutouts, these parts really do go together smoothly and accurately ; every detail has been considered and special attention has been given to interchangeability of parts, with the result that almost endless variations can be obtained from the set of six cards. Another very helpful feature is the separate sale of individual cards, enabling the modeller to extend his town or village without having to repeat the purchase of less frequently required parts, such as those of the church.

For easy handling and permanence, all main walls of "Bilteezi" buildings used on The Model Railway were lined with 1/16in. balsa wood and although the structures have astonishing strength when unlined, it is felt that this course, already adopted by many users, is worth recommending.

The manner in which buildings are arranged and the attention given to such features as gardens, commercial yards, roadways, etc., have a very marked effect on the realism of the scene as a whole and the addition of a few pedestrians, lorries and other road traffic gives the touch of life so necessary in this sphere of OO modelling. In the case of The Model Railway, lorries were built from Wilson Kits and their associated range of spare parts and Slater's plastic "Huminitures" were used to add greatly to the final effect of town and stations ; subsequently, Britain's famous "Lilliput" Series of farm animals, horses and carts, agricultural tractor and other miniatures made accurately to 4mm. scale provided similarly for fields and countryside that vital evidence of natural life and human endeavour.

(*Later note : It is very good news that the "Bilteezi" Range has now been extended by the addition of a series of lineside buildings*).

Backboards

The background to The Model Railway is in the form of hardboard painted with a few mountain and moorland impressions and large expanses of white clouds on blue skies ; particular attention is not directed to this effort here, because work in this sphere is not the *mêtier* of either of the builders of the layout ! On the other hand, it was felt most strongly that this very fact demanded that they themselves tackle it and for two reasons the decision has not been regretted ; firstly, a background is not noticed in detail and secondly (this being the more important point), the fact that this very amateur attempt has attracted neither unfavourable comment nor polite avoidance of it bears out the claim that The Model Railway (apart from its auto-control perhaps) includes nothing beyond the powers of the average enthusiast.

* * * * * *

It would now seem that this general survey has covered all the main ideas, processes and materials used in the creation of The Model Railway and yet it is probable that very few readers realise that a surprising number of commodities have received mention only by inference or without comment on the particular brand selected ; in most instances this occurs because no significance was attached to the choice in the case of the layout, as it was felt for example that one brand of cement suited the work as well as another.

There are however two vital requirements which were used in very considerable quantities and which justified careful selection of the brands used ; these are solder and liquid glue and the fact that conscious thought is seldom given to their more or less hidden part in the finished work would not justify the omission of full credit to the products concerned. Like all the more obvious factors, the brands used were chosen for specific reasons and although these cannot be detailed here, it may prove helpful to many modellers to know that Multicore Solder and Croid Liquid Glue were the selected makes.

It has already been stressed that the greatest care should always be taken in deciding on the best equipment for the task in hand and it has been pointed out that consideration should be given to every aspect, such as cost, efficiency, ease of handling, permanence or whatever qualities are apposite to the matter involved. Let it be borne in mind that many disappointments can be avoided throughout the long future of any project if a little time is devoted in the brief present to ensuring that this care is extended to what may in some cases appear to be quite obscure and unimportant factors.

CHAPTER X

IN CONCLUSION

In a very brief final chapter there are only three matters to be mentioned. There is first the very definite assurance that firms and products not mentioned in the foregoing pages are in no way slighted ; references are based on the materials and products used for The Model Railway and no other method of selecting items for comment is involved. Next is the fact that all the materials and products mentioned are spoken of highly and a thoughtless reader may feel that this is too much of a coincidence, with consequent loss of confidence in the value of the views expressed ; on the contrary, is it not sound sense that everything selected for use for The Model Railway must obviously be what is considered excellent for the job ? Praise can therefore be taken in each case as fully earned.

Thirdly and finally, the hope is again expressed that the reader has found something of interest and of service in this book and that although they merely skim the surface, the hints and descriptions may perhaps touch on just those points which have not always received attention.

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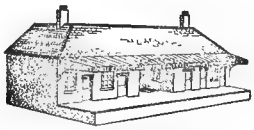

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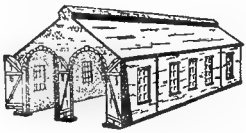

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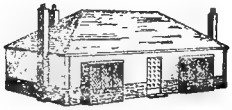

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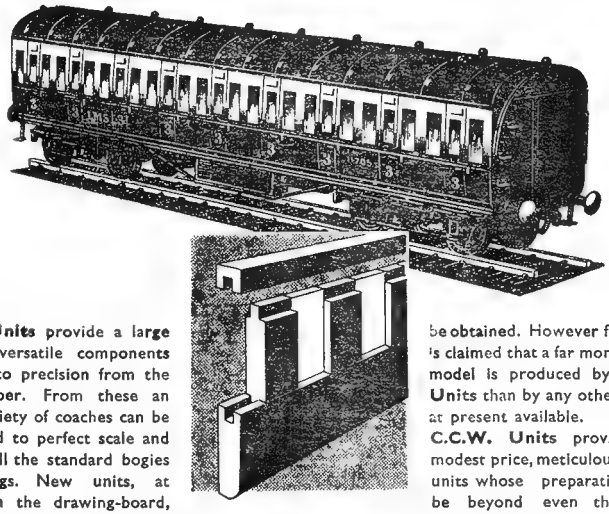

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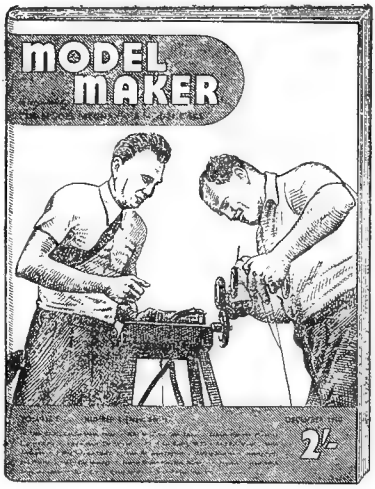

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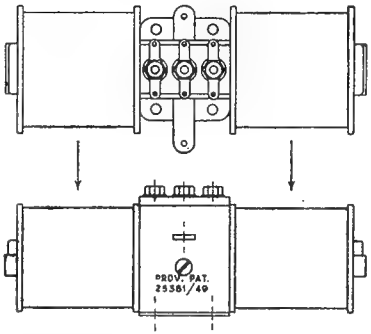

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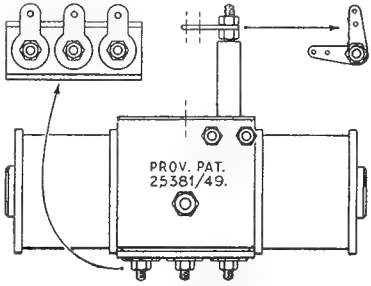

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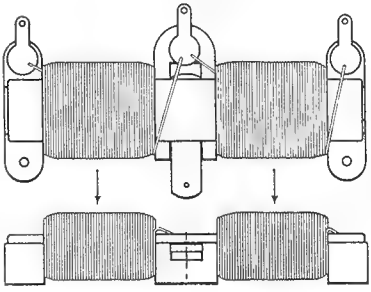

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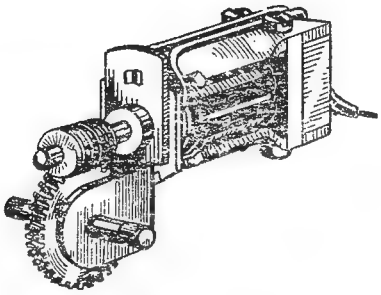

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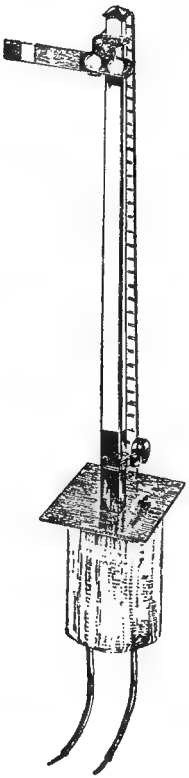

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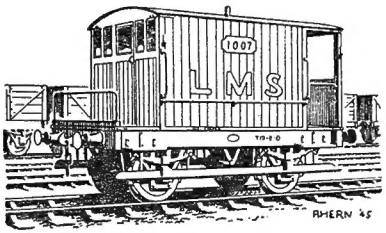

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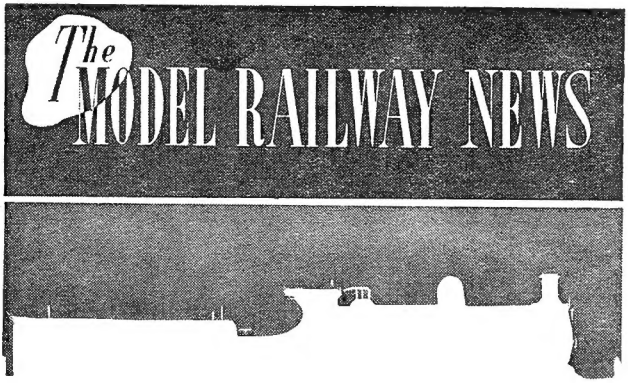

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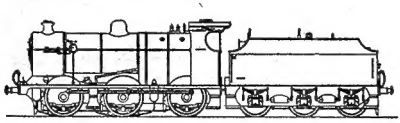

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